UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/892,586	06/27/2001	Paul Turner	1086.2002-001	2279

			EXAMINER
21005	7590	08/07/2006	SHARON, AYAL I

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ART UNIT	PAPER NUMBER
2123	

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
	09/892,586	TURNER ET AL.
Office Action Summary	Examiner	Art Unit	
	Ayal I. Sharon	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>02 May 2006</u>.

2a)☒ This action is **FINAL**.   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *22-24* is/are allowed.

6)☒ Claim(s) *1-5,7-15 and 17-21* is/are rejected.

7)☒ Claim(s) *6 and 16* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on <u>8/13/2001</u> is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____ .

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

Introduction

1. Claims 1-24 of U.S. Application 09/892,586 are pending.

2. The case claims priority to provisional application 60/214,875, filed on 06/29/2000.

3. The new grounds of rejection have been necessitated by Applicants' amendments to the claims.

4. This action is final.

Allowable Subject Matter

5. The following are statements of reasons for the indication of allowable subject matter.

6. The relevant prior art is:

   - Klimasauskas et al., U.S. Patent 5,877,954. (**"Klimasauskas"**).

   - Lightbody, et al. "Neural Network Modelling of a Polymerisation Reactor". Int'l Conf. on Control, 1994. March 21-24, 1994. Vol.1, pp.237-242. (Hereinafter "**Lightbody**").

   - Weisstein, Eric W. "Hyperbolic Tangent." From MathWorld. © 1999 CRC Press. http://mathworld.wolfram.com/HyperbolicTangent.html. (Hereinafter "**Weisstein**").

7. **Dependent Claims 6 and 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.**

8. In regards to Claims 6 and 16, the Lightbody reference expressly teaches the use of "hyperbolic tangent nodes" in a non-linear neural network used for polymer process control (See Lightbody, p.239, right column, next-to-last paragraph). Examiner interprets that these nodes perform the same purpose as the claimed "transfer function" in the non-linear network model claimed in Claim 16. However, Lightbody does not expressly teach the use of "the log of a hyperbolic cosine function" as in the limitations of Claim 16:

> 6.   The method of Claim 5, wherein the non-linear transfer function includes the log of a hyperbolic cosine function.

> 16.   The computer apparatus of Claim 15, wherein the non-linear transfer function includes the log of a hyperbolic cosine function.

Weisstein teaches at the bottom of p.2 that the integral of hyperbolic tangent equals the natural log of hyperbolic cosine, plus some constant. However, while Lightbody teach the use of "hyperbolic tangent nodes", Lightbody is silent in regards to an integration, summation, or accumulation of the hyperbolic tangent function. Examiner therefore finds that there is no motivation to combine the two references.

9. Klimasauskas also does not expressly teach the use of "the log of a hyperbolic cosine function" as in the limitations of Claim 16

10. **Independent Claims 22-24 are allowed for the same reasons detailed above.**

11. Claim 22 recites the following limitations:

22.   A computer-implemented method for building a model for modeling a polymer process, said method comprising the steps of:

specifying a base non-linear function for an initial model generally corresponding to the polymer process to be modeled, the initial model including an initial input and an initial output and the base non-linear function including **a log of a hyperbolic cosine function;**

constructing a non-linear network model based on the initial model and including the base non-linear function, the non-linear network model having multiple inputs based on the initial input and a global behavior for the non-linear network model as a whole that conforms generally to the initial output; and

calibrating the non-linear network model based on empirical inputs by using a bound on a derivative of the base non-linear function to constrain parameters of the model to produce a constrained model with global behavior the constrained model providing precision control of the non-linear empirical process.

12. Claim 23 recites the following limitations:

23.   A computer apparatus for building a model for modeling a polymer process; comprising:

a model creator for specifying a base non-linear function for an initial model generally corresponding to the polymer process to be modeled, the initial model including an initial input and an initial output and the base non-linear function including **a log of a hyperbolic cosine function;**

a model constructor coupled to the model creator for constructing a non linear network model based on the initial model and including the base non linear function, the non-linear network model having multiple inputs based on the initial input and a global behavior for the non-linear network model as a whole that conforms generally to the initial output; and

a calibrator coupled to the model constructor for calibrating the non linear network model based on empirical inputs by using a bound on a derivative of the base non-linear function to constrain parameters of the model in order to produce a constrained model with global behavior, the constrained model providing optimized approximations to a process controller for controlling the polymer process.

13. Claim 24 recites the following limitations:

24.   A computer program product that includes a computer usable medium having computer program instructions stored thereon for modeling a polymer process, such that the computer program instructions, when performed by a digital processor, cause the digital processor to:

specify a base non-linear function for an initial model generally corresponding to the polymer process to be modeled, the initial model including an initial input and an initial output and the base non-linear function including **a log of a hyperbolic cosine function;**

> construct a non-linear network model based on the initial model and
> including the base non-linear function, the non-linear network model having
> multiple inputs based on the initial input and a global behavior for the non-linear
> network model as a whole that conforms generally to the initial output; and

> calibrate the non-linear network model based on empirical inputs by using a bounded
> derivative of the base non-linear function to constrain the parameters of the model in order to
> produce a constrained model with global behavior, the constrained model providing optimized
> approximations to a process controller for controlling the polymer process.

Claim Rejections - 35 USC § 102

14. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that

form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public
use or on sale in this country, more than one year prior to the date of application for patent in the United
States.

15. The prior art used for these rejections is as follows:

- Klimasauskas et al., U.S. Patent 5,877,954. ("**Klimasauskas**").

16. The claim rejections are hereby summarized for Applicant's convenience. The

detailed rejections follow.

17. **Claims 1-5, 7-15, and 17-21 rejected under 35 U.S.C. 102(b) as being**

anticipated by Klimasaukas.

18. In regards to Claim 1, Klimasaukas teaches the following limitations:

1.   A method for modeling a non-linear empirical process, comprising the steps of

creating an initial model generally corresponding to the non-linear
empirical process to be modeled, the initial model having a base non-linear function an initial
input and an initial output;

(See Klimasaukas: col.2, lines 27-31, where Klimasaukas teaches: "The neural
network model is suitable for modeling complex chemical processes such as
non-linear industrial processes ...")

constructing a non-linear network model based on the initial model, the
non-linear network model having multiple inputs based on the initial input and a
global behavior for the non-linear network model as a whole that conforms
generally to the initial output, the global behavior being at least in regions of sparse initial input;
and

(See Klimasaukas: col.2, lines 36-38 and 47-50; and col.8, lines 59-61,

where Klimasaukas teaches: "For instance, when training data is limited and
noisy, the network outputs may not conform to known process constraints."

And where Klimasaukas also teaches: "As a result, compared to other linear
regression models, the PLS model works well for the cases where input variables
are correlated and the data are sparse."

calibrating the non-linear network model based on empirical inputs by using a bound on a
derivative of the base non-linear function to constrain parameters of the model to produce a
constrained model with global behavior of the non-linear network model, the constrained model
providing precision control of the non-linear empirical process.

(See Klimasaukas: col.12, lines 63-66, and col.13, lines 6-9,

where Klimasaukas teaches: "The neural network is trained to predict the
difference between the primary model predictions and the target variables."

And where Klimasaukas also teaches: "Further, in the event that the primary
analyzer 132 deploys a derivative calculator at the output 133, the neural network
of the error correction analyzer 136 can be trained to predict the error in the
derivative of the output 133 of the primary analyzer 132.")

19. In regards to Claim 2, Klimasaukas teaches the following limitations:

2.   The method of Claim 1, wherein the step of creating the initial model includes
specifying a general shape of a gain trajectory for the non-linear empirical process.

(See Klimasaukas: Fig.6, and col.3, lines 3-4, which teaches:

"Thus, the neural network of Fig.6 learns how to bias the primary model to
produce accurate predictions.")

20. In regards to Claim 3, Klimasaukas teaches the following limitations:

3.   The method of Claim 1, wherein the step of creating the initial model includes
specifying a non-linear transfer function suitable for use in approximating the
non-linear empirical process.

(See Klimasaukas: col.12, lines 57-60, which teaches:

"Preferably, the neurons in the neural network use a hyperbolic transfer
function such as (E.sup.x -E.sup.-x).div.(E.sup.x +E.sup.-x) for x values in
the range of minus infinity to positive infinity.")

21. In regards to Claim 4, Klimasaukas teaches the following limitations:

> 4.   The method of Claim 3, wherein the non-linear network includes interconnected
> transformation elements and the step of constructing the non-linear network
> includes incorporating the non-linear transfer function into at least one
> transformation element.

(See Klimasaukas: col.12, lines 57-60, which teaches:

"Preferably, the neurons in the neural network use a hyperbolic transfer
function such as (E.sup.x -E.sup.-x).div.(E.sup.x +E.sup.-x) for x values in
the range of minus infinity to positive infinity.")

22. In regards to Claim 5, Klimasaukas teaches the following limitations:

> 5.   The method of Claim 4, wherein the step of optimizing the non-linear model
> includes setting constraints by taking a bounded derivative of the non-linear
> transfer function.

(See Klimasaukas: col.13, lines 6-9, where Klimasaukas also teaches:

"Further, in the event that the primary analyzer 132 deploys a derivative
calculator at the output 133, the neural network of the error correction analyzer
136 can be trained to predict the error in the derivative of the output 133 of the
primary analyzer 132.")

23. In regards to Claim 7, Klimasaukas teaches the following limitations:

> 7.   The method of Claim 1, wherein the non-linear network model is based on a
> layered network architecture having a feedforward network of nodes with
> input/output relationships to each other, the feedforward network having
> transformation elements; each transformation element having a non-linear
> transfer function, a weighted input coefficient and a weighted output coefficient;
> and the step of calibrating the non-linear network model includes constraining
> the global behavior of the non-linear network model to a monotonic
> transformation based on the initial input by pairing the weighted input and
> output coefficients for each transformation element in a complementary manner
> to provide the monotonic transformation.

(See Klimasaukas: Fig.6, and col.11, lines 61-65, which teaches:

"FIG. 6 illustrates in more detail a conventional multi-layer, feedforward neural network which is used in one embodiment of the present invention as the error correction analyzer for capturing the residuals between the primary analyzer or model 132 output and the target output 115. The neural network of FIG. 6 has three layers: an input layer 139, a hidden layer 147 and an output layer 157."

And also col.9, lines 44-46, which teach:

"... where W is a weighting matrix used to create orthogonal scores and B is a diagonal matrix containing the regression coefficients b_h.")

24. In regards to Claim 8, Klimasaukas teaches the following limitations:

> 8.   The method of Claim 1, wherein the step of optimizing the non-linear network model comprises adjusting the optimizing based on information provided by an advisory model that represents another model of the non-linear empirical process that is different from the initial model, the non-linear network model, and the constrained model.

(See Klimasaukas: col.12, lines 63-66, and col.13, lines 6-9)

25. In regards to Claim 9, Klimasaukas teaches the following limitations:

> 9.   The method of Claim 8, wherein the advisory model is a first principles model of the non-linear empirical process.

(See Klimasaukas: col.12, lines 63-66, and col.13, lines 6-9)

26. In regards to Claim 10, Klimasaukas teaches the following limitations:

> 10.   The method of Claim 1, wherein the non-linear empirical process is part of a greater process, and the method further includes the step of deploying the constrained model in a controller that controls the greater process.

(See Klimasaukas: col.12, lines 63-66, and col.13, lines 6-9)

27. **Claims 11-20 are rejected based on the same reasoning as claims 1-10.**

Claims 11-20 are computer apparatus claims that recite limitations equivalent to those recited in method claims 1-10 and taught throughout Klimasaukas.

28. **Claim 21 is rejected based on the same reasoning as claim 1. Claim 21 is a computer program product claim that recites limitations equivalent to those recited in method claim 1 and taught throughout Klimasaukas.**

Response to Amendment

29. Examiner has found Applicants' arguments (see amendment filed 5/2/2006, pp.9-10) regarding the Lightbody reference to be persuasive. The rejections based on that reference have been withdrawn.

30. The new grounds of rejection have been necessitated by Applicants' amendments to the claims.

Conclusion

31. The following prior art, made of record and not relied upon, is considered pertinent to applicant's disclosure.

- U.S. Patent 6,654,649 to Treiber et al. (Similar invention with shared co-inventors as the instant application).

- U.S. Patent 6,110,214 to Klimasauskas. (Similar invention with same inventor as in the prior art applied in the rejections in this office action. Same assignee as the instant application).

- U.S. Patent 6,246,972 to Klimasauskas. (Similar invention with same inventor as in the prior art applied in the rejections in this office action. Same assignee as the instant application).

32. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ayal I. Sharon whose telephone number is (571) 272-3714. The examiner can normally be reached on Monday through Thursday, and the first Friday of a biweek, 8:30 am – 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Picard can be reached at (571) 272-3749.

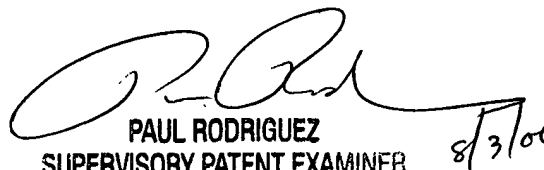Any response to this office action should be faxed to (571) 273- 8300, or mailed to:

>   USPTO
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Any inquiry of a general nature or relating to the status of this application

or proceeding should be directed to the Tech Center 2100 Receptionist, whose

telephone number is (571) 272-2100.

Ayal I. Sharon
Art Unit 2123
July 31, 2006

PAUL RODRIGUEZ
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